FREQUENCY LIMITS FOR CONDUCTING GRAPHENE CHANNEL CAUSED BY QUANTUM CAPACITANCE AND KINETIC INDUCTANCE

M.V. Strikha

V.E. Lashkaryov Institute of Semiconductor Physics,
Nat. Acad. of Sci. of Ukraine
(*41, Prosp. Nauky, Kyiv 03680, Ukraine;*
e-mail: maksym_strikha@hotmail.com)

S u m m a r y

By analyzing the Boltzmann kinetic equation for mesosystems, it is shown that the quantum capacitance and the kinetic inductance, which are analogs of the electrostatic capacitance and the magnetic inductance, respectively, have to be taken into consideration while studying the dynamic conductivity of a graphene channel, despite their different physical nature. The account of the quantum conductance and the kinetic inductivity leads to the appearance of a maximum of the impedance. In the case where the graphene channel is an ideal Landauer resistor crossed by an electron without scattering, this maximum corresponds to the THz range (therefore, the effect does not worsen the frequency characteristics of graphene FETs operating in the GHz range). However, for massive graphene channels fabricated with the use of the CVD method, where the electron transport has the diffusive nature, this maximum corresponds to the kHz or MHz range depending on the carrier mobility and the channel length.